NEW TECHNOLOGY ADOPTION IN SMALL AND MEDIUM ENTERPRISES' (SMEs) OPERATIONS: A COMPARATIVE STUDY OF AUTO-PARTS, FOUNDRY AND LEATHER ENTERPRISES OF AGRA DISTRICT

Synopsis

Submitted in the partial fulfillment of the requirements of

Doctor of Philosophy

in

MANAGEMENT

Submitted By

Chhaya Verma

Under the Supervision of

Prof. K. Santi Swarup
(Supervisor)

&

Prof. Poornima Jain
(Co-Supervisor)

Department of Management, Faculty of Social Sciences

Dayalbagh Educational Institute (Deemed University)

Dayalbagh, Agra- 282005

2022

Introduction

Small and medium-sized enterprises have been thriving in the Agra district. The leather trade is one of the district's most old and unique enterprises. Agra district is one of the greatest and most popular platforms for new entrepreneurs to set up an enterprise. Aside from young entrepreneurs, the district has piqued the interest of various large corporations, which have contributed to the district's social and economic development to an incredible degree. Along with its growing industries, the district is also well-known across the world for its "PETHA."

Table no. 1, A potential small and medium enterprise

SR. NO.	TYPE OF INDUSTRY	NUMBER OF UNITS	INVESTMENT (Cr. Rs.)	EMPLOYMENT
1.	Agro-based	561	153.42	3384
2.	Chemical/Chemical based	30	7.308	370
3.	Electrical machinery and transport equipment	101	1.06	397
4.	Engineering units	309	69.268	4150
5.	Leather-based	932	156.089	11320
6.	Metal-based	74	4.9	430
7.	Mineral-based	13	0.27	27
8.	Paper & Paper products	60	12.52	612
9.	Petha	470	7.8	2000
10.	Ready-made garments & embroidery	857	9.68	4565
11.	Repairing & servicing	2210	99.55	9212
12.	Rubber, Plastic & petro based	89	22.376	2016
13.	Wood/wooden based furniture	179	2.035	668
14.	Woolen, silk & artificial Thread based clothes.	7	1.19	42
15.	Others	1324	80.065	11926

(Source: DIC Agra)

Printing Industries prompt under many categories on top of broad ideas. As a result, detailed information on an appropriate location, capital investment within the plant in machinery, asset requirements, human resources, introductory material, marketability, gain, and so on are available for each prompt item from MSME-DI, Agra in the form of project report on demand from the appropriate entrepreneurs for starting their venture on the chosen things.

As several as 13 large integer MSME units in Uttar Pradesh which are given loans value Rs. 42,700 crores within the year (2020-21) by the state government. In addition, for the primary time within the state's history, such a large quantity of loans has been given to the MSME sector in a year. This has

additionally generated 65 lakh direct and indirect employment opportunities in the private sector. Uttar Pradesh is home to 14% of the country's small and medium-sized enterprises (MSME).

MSME sector accounts for the second-largest employment generation next solely to the agriculture sector in the state. Additionally, it is the leading state in the Republic of India regarding the number of individuals used in MSME. There is a complete of 92.36 lakh employees employed during this sector, out of that the unregistered sector employs over 90 % (84.86 lakh) **(Source: DIC Agra)**

Cluster-wise Classification of MSMEs in Uttar Pradesh

Traditionally, there has been a development of a group of units producing equivalent or similar merchandise in near geographical proximity to each other. Such groups are known as clusters.

1. It gives rise to external economies (e.g. specialized suppliers of raw materials, components, and machinery; sector-specific skills, Etc.);
2. They favor the emergence of specialized technical, body, and monetary services;
3. It create a contributory ground for the event of inter-firm cooperation and specialization further as cooperation among public and personal native establishments to push native production, innovation, and collective learning. In Uttar Pradesh, several specialized clusters offer large-scale employment and conjointly add considerably to the exports from the state. The Marble enterprises of the urban center, woodcraft of Saharanpur, Chikan enterprises of Lucknow, a leather enterprises of Kanpur and urban center, the brass enterprises of Moradabad, glass enterprises of Firozabad, Ceramic and Patri enterprises of Khurja, and also the Carpet enterprises of Bhadohi are of world fame

DETAIL OF CLUSTERS

1. **Name of the cluster:** Auto-parts

Table no. 1, Clusters of Auto-parts

1.	Principal Products Manufactured in the Cluster	Iron, aluminum and auto parts manufacturing
2.	No. of functional units in the clusters	70
3.	Turnover of the Clusters	Rs 200 lakh per/annum
4.	Employment in Cluster	6500
5.	Average investment in plant & Machinery	Rs 75000/
6.	Major Issues/requirement	Technical & Marketing Support

7.	Thrust Areas	Technology/ Product/ Market/ Export/ quality etc.
8.	Problems & constraints	Highly Unorganized Cluster No design and technology intervention No proper Forward Linkage Support from Technology Institutions

2. Name of the cluster: Foundry

Table no. 2, Clusters of Foundry

1.	Principal Products Manufactured in the Cluster	Iron, steel, and alloy castings
2.	Name of the special purpose vehicle (SPV)	Agra Iron Founder's Association (AIFA) National Chamber of Industries and Commerce,
3.	No. of functional units in the clusters	80
4.	Turnover of the Clusters	550 lakh per/annum
5.	Value of Exports from the Clusters	Rs 100 crore
6.	Employment in Cluster	30,000
7.	Average investment in plant & Machinery	Rs. 50,000
8.	Thrust Area	Technology/ Product/ Market/ Export/ quality etc.

3. Name of the cluster: Leather

Table no. 3, Clusters of Leather

1.	Principal Products Manufactured in the Cluster	Leather Footwear, Handbag
2.	Name of the special purpose vehicle (SPV)	Agra Juta Laghu Udhyog Utpadan Samiti
3.	No. of functional units in the clusters	90
4.	Turnover of the Clusters	600 Lakh Per/ annum
5.	Value of Exports from the Clusters	Rs. 2150 Crore
6.	Employment in Cluster	Rs 2 lakh
7.	Average investment in plant & Machinery	Rs 1 Lakh (Except Exporting Units)
8.	Major Issues	Shortage of Skilled Stitchers Working Capital Shortage of Finished Leather Infrastructural facilities Govt. Policy
9.	Presence of capable Institutions	CFTI, FDDI, GLI
10.	Problems & Constrains	Skill Manpower, Shortage of Leather
11.	Testing Needs	Local Testing Needs are required. Units facing Hardships & testing from FFDI NOIDA

With the advent of globalization, several changes have taken place in the production process and business enterprises. The use of technology is not new in these sectors, but adoption of technology is a

recent phenomenon that impetus the operation management to adopt the new technology effective and efficient and results to make the enterprise successful.

Let evaluate how technology assists in numerous activities of enterprises management.

Supplier Management: the utilization of IT in supplier management is the use of software to store and method supplier-related information. It involves receiving, storing, and provisioning raw materials from completely different suppliers.

Manufacturing Operations: This involves actions, processes, and activities related to changing the fabric inputs into the finished product. Its sub-activities embrace materials management, production planning, computer numerical management (CNC), and computer-aided manufacturing (CAM) technologies.

Technology Development: This activity is recommended by computer-aided design (CAD) software that assists engineers in designing and drafting activities.

Information Technologies as the Key, the emerging key technology areas for enterprises, are mobile technology to help customer base, supply chain, enterprises management software catch up and compete with big companies and e-commerce. Smaller enterprises can derive their services and product with support from social media, which will help build and strengthen an ecosystem of innovation. Smaller enterprises can enjoy the benefits of the latest technology. E-commerce can help them to reach out directly to customers.

Small and medium enterprises are experiencing the technology-driven transition of the economy. The innovative use of emerging technologies has resulted in a paradigm shift. Making effective use of information technology to address the ever-changing need of the industry and the customers is the real challenge and the real opportunity. Enterprises need to examine emerging information technologies and see how to transform IT implementation challenges into growth opportunities. MSMEs use their flexibility, anticipation, agility, and adaptability strategies to implement emerging technology innovations better than larger enterprises. Enterprises should decide what IT applications they need and determine how best to deploy them. They have created an information technology implementation framework that can guide them during different stages of critical decision-making. The scenario is changing rapidly.

Small and medium enterprises adopt these new technologies and use them in additional innovative ways much quicker than more big corporations. Currently, most of the technologies are offered as services e.g.

- Artificial Intelligence
- Cloud Computing
- MS-Office
- Software-as-a-Service (SAAS)
- Software intelligence (quality & quantity check)

Small and medium enterprises are getting more agile to technologies like IOT, social media, mobility, analytics, and cloud computing are coming to open unlimited opportunities for everybody.

Social Media: A social media strategy has become a requirement for all types and all sizes of enterprises. Over one billion people logged on to numerous social networks; folks are currently using social media for recommendations on what merchandise to shop for, wherever to buy, and even relating to what corporations they need to figure. **(Source: UP MSME)**

Mobility: Mobile devices have modified the way for enterprises to access digital content. Smartphones and Tablets have brought made digital content to the fingertips of customers. Mobile banking has emerged mutually of the foremost innovative merchandise within the money services trade. Customers are more and more using their mobile devices for everything from browsing to scrutiny to purchasing merchandise.

Analytics: Every year, firms and people generate billions of gigabytes of knowledge. Data that is correctly analyzed and utilized in time will emerge as an unbeatable competitive advantage. Enterprises ought to acknowledge the prospect analytics represents and may adapt their IT strategy to capture such opportunities. **(Source: UP MSME)**

Biometrics: Biometrics is an enrollment and verification tool that assists SMEs not only in securely identifying a person but also in carrying out a variety of activities such as actual-time monitoring, access control, and the transformation of the digital payment process.

Cloud computing: Each IT vendor and IT user accepts the undeniable power of cloud computing to foster innovations and improve productivity.

To manage cloud computing in operation management, enterprise must follow:-

- The proper tools and resources should always be used to conduct any function in the cloud, and enterprise processes should be completed at the right time and at the right cost.
- To handle repeated jobs, the process should be systematize and automated.
- Using an efficient procedure eliminates effort waste and redundancy.
- It is important to maintain service quality in order to prevent having to redo work later.

The following four pillars of small and medium enterprises operation management which can place them in a stable position:-

1. Perceive and develop marketplace & procurance ways

It is necessary to grasp marketplace however small and medium enterprises compete within the marketplace to make a short-term and long-term procurance strategy. Many times firms have a variety of products and market opportunities. One ought to be ready to look at these ways and build one that works for the enterprises. An operational excellence strategy should be applied wherever rock bottom price is a crucial provider criterion if the enterprise is a cheap supplier.

If the enterprise targets building strong client relationships, then the customer-centric enterprise's strategy should be used where service, not cost, is the preponderating criteria. Select suppliers who perceive the service requirements; however, note that high valuation might be, which may well be acceptable in the market section. Ask for suppliers which seek more versatile and service-oriented to satisfy all client demands.

2. Determine sturdy suppliers and nurture those relationships

The procurance enterprise ought to be sturdy of provider choice. Encourage participation by small and medium enterprises workers that matter experts, however, take the ultimate responsibility. The strength of essential suppliers is that the foundation of effective operational ways. They distinguish credible sources of an offer, which will facilitate the corporate to meet current operational commitments and scale because the enterprise grows.

Some small and medium enterprises feel they are not necessarily enough to determine sturdy provider relationships. That thinking is misguided. Most operational organizations' segments and their customers' area units actively seek out a decent mixture of enterprises by size, market, and sales

potential. Any enterprise will establish sturdy and vivacious provider relationships, although size can clear ways in which for provider communication and opportunities to figure along.

Resist computer program sourcing. Whereas an online search might determine flourishing suppliers, it should additionally offer a confusing landscape. The web search is usually way too broad, distinguishing suppliers more targeted on customers than enterprise. Operating with industry-specific archives, trade associations, and professional publications can expose the small and medium enterprise to enterprises-oriented suppliers who meet the service, technical, quality, and valuation necessities.

3. Develop quantitative and qualitative metrics to manage the suppliers

It is never too late to trace the suppliers' performance. There is no ought to await sophisticated ERP software to try and do the task for them. Establish key performance measures like on-time delivery and quality, and track the performance of necessary suppliers. Establish a few measures of key performance indicators.

One vital Key Performance Indicator (KPI) is on-time delivery. Establish a group of suppliers and track their delivery performance on a part basis, comparing their committed delivery date to the particular delivery date. Use associate MS-Excel spreadsheet to investigate drift.

Showing providers that enterprises center on supplier performance by reviewing the information can strengthen the account, give strength in negotiation and facilitate the suppliers to boost their enterprise's operations. Regular conferences around performance will cause discussions that may improve performance and scale back prices.

4. Manage risk within the prolong provide chain

All firm's expertise risks; however, small and medium enterprises are also vulnerable to perceived lack of leverage and potential money impact. By adopting the new technologies, enterprises predict the long-run methods or the market situations by examining the past results of the market. Guarantee continuity of providing by distinguishing vital path suppliers within the extended provide chain. However, the suppliers are handling risk in they provide chains. Incorporate those plans into the company's own.

- **Facilitate new payment choices.** For several small and medium enterprises, MasterCard and Visa Card are the two primary members of the accounts due to the department. Whereas accessing

personal and enterprises credit lines is also acceptable for workplace supplies and the native hardware store, the bank and financiers need to check much substantial money and written agreement relationships with critical suppliers.

- **Protect confidentiality and science.** Be paranoid around confidentiality and also the protection of holding product identity. Need all key suppliers to sign a non-disclosure agreement. If there are vital sub-suppliers, have them sign one further. Confidentially clauses additionally ought to be a part of the prints and specifications.

Operation Management is a collaboration between associate enterprise and its producing and wholesale distribution channel partners. This collaboration is driven by technology and is helpful for every kind of enterprise; small and big, new and old. However, whereas big and old enterprises typically take full advantage of providing operation management, new small and medium enterprises do not provide the importance and focus it deserves. It is necessary to notice that to own an efficient trafficker Managed Inventory system, firms ought to try and integrate advanced practices and the latest technology out there.

Technology drives the worldwide success of small and medium enterprises. The adoption of technologies ought to be across the whole worth chain and the first activities of producing and supporting activities like administration, human resource management, and design. Economical and practical technology adoption is vital to the productivity and fight of tiny and medium enterprises.

Globally, technology is known as a critical element for market development. Those that proactively use leading technologies get an essential market edge over technology stragglers. Enterprises that are early adopters of technologies tend to own higher growth methods and become core opinion formers in their group, obtaining an upper hand over their competitors.

Growth in technology has modernized the enterprise`s environment for sleek small and medium enterprise development actions to happen. Information technology has created the collection, analysis, and dissemination of knowledge a lot easier and inexpensive. Low cost, high-speed digital technology, and data transmission hardware combined with the provision of a good variety of software applications have made enterprises' development quicker and more practical than it was earlier.

Small and medium enterprises ought to create themselves a part of the innovation networks, although

being a part of such networks could be a long and exacting activity, notably with a resource crunch, the face. The Federation of Indian Chambers of Commerce & Trade (FICCI) plays a significant role in sharing, learning, training, and intelligent practices. They will become the most entry purpose for small and medium enterprises in local innovation networks. However, availability or lack of social capital among these enterprises remains a crucial consideration deciding the success or failure of such a network.

Time, space, and alternative temporary constraints have lost their significance, and their significance has been eliminated in several cases. Customers nowadays favor having straightforward and quick availableness of precise information for creating their purchase selections. There has been a transparent shift in power from sellers to customers. Technology has to facilitate this method of transition and transformation. Technology is that the future and the way forward for technology can successively be the long run of small and medium enterprises development. Enterprises ought to imagine this currently and set up their journey into the new technology-driven world. Small and medium enterprises rely upon new technologies for the future wave of their enterprise's success. Technological up-gradation is not a selection at present. Instead, it is a necessity. However, the key challenge remains: using the available new-age technologies to develop our future enterprises` development methods and embrace them to succeed in new markets, new products, customers, and new revenues. As it goes, technology has considerably revolutionized the manner of doing enterprises and selling products and services.

Technological Innovation and small and medium enterprises are more positioned to generate new and innovative concepts; however, larger companies are more efficient at implementing the innovations. If enterprises attempt to determine and perceive the factors that influence the adoption of the latest and innovative technologies, the degree of awareness that the MSMEs have regarding numerous out there technology solutions has emerged because of the critical factor. Effective government policies, institutional and technical support by the R&D establishments, enterprises enterprise incentives, and design assistance programs readymade for the MSMEs play an integral role in adopting the latest technologies. Despite the many attempts by the govt., the MSME sector still incorporates a downside in accepting the offerings for technological development and up-gradation. Small and

medium enterprises are inherently and excessively suspicious of all the new technology encounters. There are plenty of government-funded schemes and support programs for the enterprises for encouraging them to upgrade or adopt new technologies. However, smaller firms face severe limitations in terms of workforce and finance and their capability to be a part of out there innovation networks.

Most such small and medium enterprises are assured in their technology capabilities and directed towards information technology/software serving to integrate the complete enterprise. Such enterprises use enterprises management or analytic software system for decision-making. They use mobile technology to remodel their enterprises and also are finance social and cloud platforms. Therefore, around the world, such corporations are to blame for higher job growth and innovations. Regardless of those who do not seem to be that proactive in their technology adoption, they often fail to envision the potential edges of the technology, think about ROI on technology un-favorable, or have serious resources crunch each monetary or workforce.

Factors Impacting on Technology Adoption

The following factors mainly promote the use of technology among MSMEs

- Change in Enterprises Environment
- Customer Demand
- Availability of skilled workers
- Perception of global competition and growth opportunities
- Operation issues
- Policy environment

Why is that the adoption of technologies necessary? Until now, the selection of technologies on the market to enterprises was, for the most part, determined by the requirement to extend production, profits, and productivity. The most significant constraints were the supply of capital, knowledge of a way to use the technology, and market risks — risks in several government policies. Within the past, "good policy practices" were relatively simple, relating primarily to increasing output and enterprises policies aimed at extending productivity within the economy. Enterprises analysis and extension

services might concentrate, as an example, on raising the productivity and reach of small and medium enterprises.

Uncertainty could increase even a lot in the future. There might also be uncertainty associated with the longer-term policy atmosphere, particularly regarding support, trade, and pressures from the enterprises. Adopting technologies by small and medium enterprises is an investment. Technological modification has been the premise for increasing enterprise productivity and promoting its development. Analysis affects the productivity of enterprises systems by generating new technologies that, if applicable to enterprises' circumstances, are apace adopted. Traditionally, researchers and extension employees are primarily to blame for distinctive and injecting economic and environmental factors into developing and introducing enterprises innovations.

The process involved in the adoption of technologies:

- **Diffusion**: - Diffusion is when a brand-new plan, practice, or technology spreads during a given population. The characteristics of technologies, like a relative advantage, complexity, quality, observability, and compatibility, affect their diffusion. Small and medium enterprises employees are inspired to adopt applicable technologies for property enterprises systems if the distribution of information is economical.
- **Enterprises policies: -** Enterprises' environmental policies that set performance standards, as opposed to forcing the utilization of specific technologies, tend to encourage innovation of a form that lowers the price of achieving a given result. Technology should return on there is also associate degree interest in encouraging its fast adoption. At that time, it is too late to begin educating the educators, the extension agents, and others to blame for explaining to small and medium enterprise employees the deserves of the technology. It is, therefore, necessary to facilitate the distribution of improved enterprises system technology.
- **Assimilation and adoption: -** Assimilation and adoption of the latest and on-the-market technology at the minor level may be a performance of science, economics, and human behavior. The inspiration of technology development and economic science typically is a robust inducement for adoption. Technology and alter can be assimilated and enforced when the advantages of implementation are quickly complete (within one to 2 years), the tools for implementation are

readily on the market and accessible within the native marketplace, the risk of the implementation is tiny, and also the modification or new technology are often well integrated into alternative fundamental on-going aspects of everyday life.

Technology Acceptance Model (TAM)

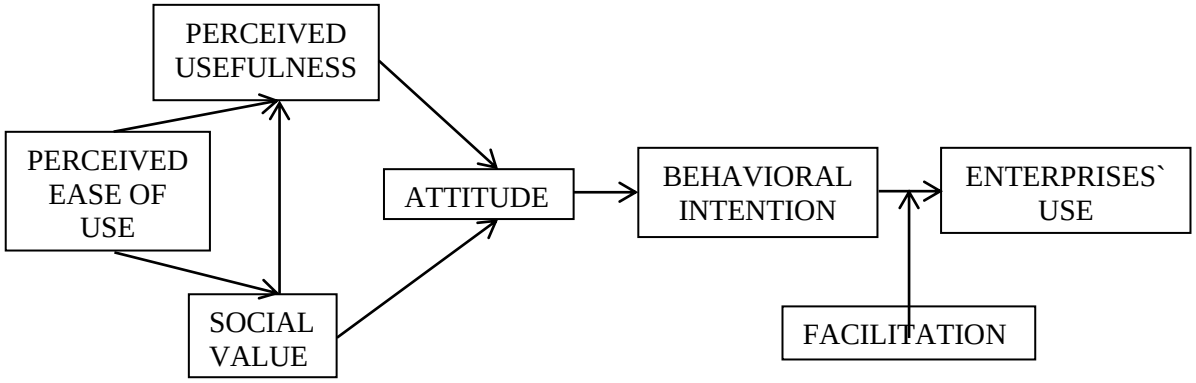

Figure 1, Technology acceptance model (Source: Davis, 1989)

Technology Acceptance Model (TAM; Davis, 1989) has been one of the most influential models of technology acceptance, with two primary factors influencing an individual's intention to use new technology: perceived ease of use and perceived usefulness.

Technology Acceptance Models (TAM) is very useful for a governance point of view so if we start with the end point is "actual use or the enterprises' use" this is what enterprises want if they want to be able to do with an operational technology so what are the factors that lead someone to actually use a technology well firstly they can form a "behavioral intention" to use it and that in turn is influenced by the "attitude" which means, "what they think of the technology if they like it the general impression and from there they'll form the intention" and then go on to use it so what affects into "attitude" and that is the subject of Technology acceptance modeling. There are two competing aspects but generally the factors that people measure when looking at technology acceptance models and using to evaluate a technology the biggest one is, "usefulness" whether or not enterprises perceives that technology is useful for what they want to do, for example, calculating something accessing a record accessing and do the operation management. The number two is "ease of use" is there is the technology easy to use if it is then that barrier is conquered but if it's not easy to use if the interface is complicated who is going to want to actually have a positive attitude towards that no one so that's really important, and the third

aspect that's really important is “social value”. Are there is only one thinking of using it, Are they have support from the government, Are their peers using the technology, so social influence is generally in the literature. It is the most important factor in determining the “attitude” towards it in “social value” is also whether or not the technology is compulsory or not so. For example, Operation management system if this is being introduced into the enterprises and it's the only one enterprise can use while their social influence is very strong and that can peers to other enterprises. But, there one aspect of it called, “facilitations” which means that would be things like support training access and so on so all of those practical things for enterprises to go and use the technology when they needed to.

Here, the question arises that, why do enterprises use technology? One theory to explain this is called the technology acceptance model and that's a model that tries to explain why people would choose to use a particular technology in a work context the theory states that they do so because they find the technology useful for the work and easy to use. The theory says very little about the technology itself what it says a lot about is what we believe or what we perceive from the this technology, in other words whether technology is actually useful or actually easy to use is not a matter of the technology but a matter of our perceptions and this may change obviously so depending on how much experience you have how old you are what gender you are the perceptions of a particular piece of technology say, if own say mobile device or a tablet computer changes not because the technology is different but because you and I are different.

Limitations of the Technology Acceptance Model (TAM):-

1. It assumes that people plan their behavior and that they're rational in their actions this means it assumes that we actually evaluate usefulness in ease of use of a technology when we develop an intention to use it and therefore actually use it the problem with that is that people are not entirely rational in their decision-making and not entirely rational in their behavior either so not everything that we do is planned a reason the theory doesn't really account for this.
2. It doesn't tell us unfortunately how to make technology easy to use or useful in other words it doesn't give us any design advice how we should build better technology other than this very general statement of make sure it's useful and make sure it's easy to use and it might also means that all technology is designed to that extent but as we all know not all technology's actually useful

are actually easy to use which is why there are no alternative theories that suggest different reasons why people adopt new technology, for example, based on the expectations that they form about the technology and whether these expectations are then confirmed or disconfirmed when they engage with the technology this shows that every theory is good at explaining something and not so good at explaining other things. TAM is no different.

Review of literature

Table 4, Review of literature

Sr. No.	Author & (year)	Topic	Objective	Findings
1	Filippo Lanzini, Jolien Ubacht, Joachim de Greeff, (2021)	Blockchain adoption factors for SMEs in supply chain management	To understand the role for SMEs in SCM if large consortia unilaterally decide to adopt a blockchain-based architecture to improve the performance of the entire supply chain	These studies may guide blockchain consortiums and supply chain stakeholders, as well as policymakers, on how to include SMEs' interests into blockchain-based applications and how to employ instruments to remove adoption obstacles.
2	Fauzan Ramadhan, Ahmad H. Sutawidjaya (2020)	Effect of operation management on firm performance of micro and small enterprises	Understanding the operational performance has a direct and Positive influence on firm performance. Optimal operational performance within the organization can influence and increase firm performance in SMEs.	Operational performance has a direct and positive influence on firm performance. Optimal operational performance within the organization can influence and increase firm performance in SMEs. Quality and operation management directly affects firm performance without operational performance mediation.
3	RavinderKumar, Rajesh Kr.Singh, Yogesh Kr.Dwivedi, (2020)	Application of industry 4.0 technologies in SMEs for ethical and sustainable operations: Analysis of challenges	To observed that the application of Industry 4.0 technologies may help in achieving the goal of ethical and sustainable operations	The study will help SMEs in formulating strategies for implementing Industry 4.0 technologies for ethical and sustainable business processes.
4	Nilubon Chonsawat, Apichat Sopadang, (2020)	Smart SMEs 4.0 Maturity Model to Evaluate the Readiness of SMEs Implementing Industry 4.0	To proposes the Smart SMEs 4.0 maturity model and its implementation for assessing the readiness of an organisation to enter the realm of smart manufacturing.	This research focuses on SMEs capability and can also help companies to implement Smart SMEs 4.0 efficiently

5	Edmund Mallinguh, Christopher Wasike and Zeman Zoltan (2020)	Technology Acquisition and SMEs Performance, the Role of Innovation, Export and the Perception of Owner-Managers	To understand the proportion of the capital budget allocated for the acquisition of technology positively and significantly influences sales.	The study significantly positive relationship between the capital's budget for acquiring new technology and sales; this confirmed the proactive strategies in acquiring new technology.
6	Moh'd Anwer AL-Shboul, (2019)	Towards better understanding of determinants logistical factors in SMEs for cloud ERP adoption in developing economies	The purpose of this paper is to investigate the main determinants logistical factors that have an impact on the adoption of cloud enterprise resource planning (ERP) among small- and medium-sized enterprises (SMEs) in developing economies.	It utilized in enhancing the strategies for approaching ERP cloud by pinpointing the reasons why some SMEs choose to adopt this technology, while others still do not go forward with this.
7	Mwamisha D. Mkala, Kenneth L. Wanjau, Teresia N. Kyalo (2018)	Operations Management and Performance of Manufacturing Small and Medium Enterprises in Kenya	The purpose of this study was to establish how entrepreneurial orientation enhances the relationship between operations management and firm performance.	The managers of manufacturing SMEs should prioritise an organisational policy shift that embeds entrepreneurial orientation in all the firm's operations. It recommends that the government should support manufacturing SMEs through enactment and promotion of policies supportive of enterprises management practices which exploit a firm's stock of EO.
8	Swetadri Srinivasan & Gurusiddayya (2017)	Operations Management in a Demanding World for SMEs	To understand the Operations management that comprises those areas of management concerned with productivity, quality, and cost in the operations function.	By employing some of the tools described above, like good strategic planning and proper use of company's resources like people, technology and equipment, and good leadership, SMEs can succeed in the face of stiff global competition.
9	Alexandre Moeuf, Samir Lamouri, Robert Pellerin, Simon Tamayo Giraldo, (2017)	Industry 4.0 and the SME: a technology-focused review of the empirical literature	The aim of this paper was to analyze the exploitation of the means of realization of Industry 4.0 within SMEs for production planning and control.	SMEs are recognized for their flexibility and proximity to customers, and are also recognized for their low investment capacity and short-term strategy. In this sense, some means of realization cannot support the strategy of SMEs
10	Naief G Azyabi (2017)	The Role of Information	This research aims to investigate the influence	The study reveals the lack of IT support in businesses of

		Technology in Enhancing SMEs Capabilities through Knowledge Management	of managing internal and external knowledge on the enhancement of the dynamic capabilities in small and medium-sized enterprises (SMEs)	SMEs which leads to high cost of production, waste, and delay presenting challenges for organizational renewal and adaptation
11	Sushanta Tripathy, Satyabrata Aich, Anurup Chakraborty, Gyu M. Lee, (2016),	Information technology is an enabling factor affecting supply chain performance in Indian SMEs: A structural equation modelling approach	To identify the success factors for supply chain in Indian small- and medium-scale enterprises (SMEs) and establish a causal relationship among them.	IT holds the key to achieve the SCM competitive advantage in SCM practices of SMEs in India.
12	Ademola Afolayan, Eoin Plant, Gareth R.T. White, Paul Jones, Paul Beynon-Davies, (2015)	Information Technology Usage in SMEs in a Developing Economy	the use of information technologies among small and medium-sized enterprises (SMEs) in a developing economy.	The successful adoption of ICT in developing economies is an essential component of their ability to make a significant contribution and is necessary for their continued growth.
13	Hart O. Awa, Ojiabo Ukoha, Bartholomew C. Emecheta (2015)	Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs.	The integrated constructs-company mission, individual difference factors, perceived trust, and perceived service quality improve existing knowledge on EC acceptance and provide bases for informed decision	The paper integrates somewhat technological determinism and social constructivism to broadly make informed decisions amidst globalization of markets, growing interpenetration of economies, and increased interdependence of economic agents, which individually or severally combine to reshape competitive environments.
14	MonicaColin, RaquelGalindo, OctavioHernández, (2015)	Information and Communication Technology as a Key Strategy for Efficient Supply Chain Management in Manufacturing SMEs	This paper aims to analyze the relationship between ICT, strategies and SCM	The use of ICT facilitates the handling of information resources (materials) and the avoidance of delays, which results not only in cost reductions but also in an increase in client compliance and thus it fosters the overall competitiveness of the organization.
15	Octavio Hernández Castorena, Luis Aguilera Enríquez, Martha González Adame, (2014)	The influence of information technology and communication supply chain management performance for greater sme	To identify the information technology and communication (ICT) have influence on the supply chain management in manufacturing SMEs	The employers establish strategies to enable all workers to improve their skills in the subject of ICT and in this sense, the results are to be useful for decision making and for the better Management of supply chain

		manufacturing in aguascalientes		
16	Kwabena G. Boakye, Thomas McGinnis, Victor R. Prybutok, (2014) ,	TAM: A quality technology acceptance model for technology operations managers	To identify the quality factors that affect customer acceptance and intention to continue purchasing disposable technology.	This study makes a case for a quality technology acceptance model (Q-TAM) that encourages technology operations managers to focus their ef- forts on quality to ensure that their products satisfy customer needs and are perceived as useful This study results the case for a quality technology acceptance model (Q-TAM) that encourages technology operations managers to focus their efforts on quality to ensure that their products satisfy customer needs and are perceived as useful
17	Norm Archer, Shan Wang, Claire Kang, (2008)	Barriers to the adoption of online supply chain solutions in small and medium enterprises	The objective of this paper is to identify and measure the perceived importance of barriers in the SME community to the adoption of internet business procurement and supply chain solutions.	There is a significant dependency among supply chain partners in decisions on adopting online links. Flexibility, agility and ability of SMEs can help them to use partial e-business solutions for low volumes of business, but this approach can be very ineffective when transaction volumes are large.
18	Petra Schubert And Uwe Leimstoll (2007)	Importance and Use of Information Technology in Small and Medium-Sized Companies	To understand the importance. And the use of information and communication Technology (ICT) in Swiss small and med ium-sized companies (SMEs).	The final objective of our study on ICT use in SMEs is The identification of typical ICT company patterns. The The resulting clusters are intended to be characterized by a Combination of observable characteristics and the typical Attitude towards a strategic and operational use of ICT.
19	Louis Raymond, (2005)	Operations management and advanced manufacturing technologies in SMEs: A contingency approach	Increased requirements for competitiveness, innovation, quality, flexibility and information processing capability have led a number of small and medium-sized enterprises (SMEs) to implement advanced manufacturing technologies (AMT).	Increased uncertainty in the SMEs' environment leads to increased CSF levels but not to increased assimilation of AMT.

Research gaps:

While reviewing the literature it is observed that most of the researches do not cover adoption of technology in small and medium enterprises, and there is not as such relevant study on new technology adoption in small and medium enterprise`s operations and the actual SMEs employees to adopt the technology. Further, since technology adoption in operations is still in the infancy stages, especially in an emerging economy like the Agra district, there is not a single study that comprehensively covers the enablers and challenges of this technology adoption. The present research aims to fill this gap. This research will be conducted with different enterprises of the Agra district and target audiences in companies that adopt technology to understand a more cohesive and holistic view of technology adoption in operations by SMEs.

Statement of Problem

Most of the small and medium enterprises are unaware of the use of new technology in their operation management, resulting in inefficient work results and decline in business opportunities.

Technology is the base of all business enterprises which is essential to enhance the production of goods and services with the changing globe scenario, new technology has been replacing the old technology for the requirement of accuracy.

Benefits of new technology are the improvement of productivity, saves time in process and tasks, cheaper manufacturing of product, cloud computing and cloud services.

Government of India launched the policies for ease of doing business, the Ministry has launched a robust Information and Communications Technology (ICT) based Internet Grievances Monitoring System portal called 'Champions'. The 'Champions' stands for Creation and Harmonious Application of Modern Processes for Increasing the Output and National Strength. The 'Champions' portal is a combination of technologies formed to help, guide, empower, ease and support the MSME sector of the country.

The purpose of this research is to determine the impact of new technology adoption on the operation management of small and medium enterprises (SMEs). It also determines the effective and efficient use of technology in the operation management of small and medium enterprises.

Need of the study

In a developing district like Agra, lack of technology might be a significant issue that affects the overall growth of small and medium enterprises. It is a significant element of the socio-economic status of any enterprise. Small and medium sectors contribute to the employment status a lot because it suits the weaknesses of the enterprises' components like- lack of capital, low level technology, lack of well-developed infrastructure, Etc. Due to these reasons, it is essential to study the role of technology in the operations of small and medium enterprises.

Significance of the study

This research seeks to investigate the relationship between the adoption of new technologies and the traditional method of small and medium-sized business operation management. Future researchers, entrepreneurs, and managers, among others, will get benefit from this research.

Although there is scope for all types of SMEs to scale up capacity and grow, only a small percentage of them do so in OECD countries. Most SMEs, including start-ups, show lower levels of productivity and wages, lower levels of technology adoption and innovation, or lower levels of internationalization and participation in global value chains.

Conditions and barriers to SME and start-up performance vary with business environment, market conditions, institutional and regulatory framework, or their access to infrastructure and strategic resources, such as skills, finance, knowledge, data, technology or networks, etc. **Source: OECD**

Objectives of the study

1. To identify what are enablers and barriers to the adoption of new technology in SMEs.
2. Designing effective and efficient model adoption of technology in SMEs.
3. To compare the use of new technology in the operation management of SMEs of auto-parts, foundry, and leather.
4. To study the efficacy of new technology adoption in SMEs.

Scope of the study

To be successful in the operations of small and medium enterprises, it is imperative for the enterprises that they should be suitably equipped with the latest technologies. A structural change in the technology ownership of enterprises is a must. To face global challenges and to enter into

new markets, the latest technology is of utmost necessity for small and medium enterprises. For sustainability and survival, technology can play an important role. It helps in efficiently integrating with international markets and optimizing the production process. Therefore, the key to success for small and medium enterprises is technology-driven innovation and differentiation.

Hypothesis construction

- **H_o: -** There is no difference in sales before the adoption of technology and sales after the adoption of technology in operation management.
- **H_o: -** There is no difference in time saving before adoption of technology and time saving after the adoption of technology in operation management.
- **H_o: -** There is no significant relationship between the enablers to the adoption of new technology.
- **Ho: -** There is no significant relationship between the barriers to the adoption of new technology.
- **Ho: -** There is a no relationship between the sustainable technology adoption and the growth of the enterprises.
- **Ho: -** There is a positive relationship to compare the use of new technology in the operation management of SMEs.
- **H_o: -** There is no change in efficacy in the SMEs operational management.

Research Methodology

Area of research: Agra district

Research design: Exploratory and analytical

Source of data collection: The research phase of this proposed thesis would involve both primary and secondary data sources.

Indicative secondary data sources:

SMEs Sustainability Reports, Annual Company Reports, Journals And Books, Relevant Web Sites, Data Available With State And Central Organizations, Process And Product Development Center office Agra.

Primary data sources:

Interview schedule answered by SMEs workers and the owners.

Tools of data collection: Paper questionnaire or computer-assisted interviewing system. Case Studies, Checklists, Interviews and Surveys or Questionnaires are all tools used to collect data.

Sampling/Census Method

There are 14 clusters in Agra district, out of which we have selected three clusters (auto-parts, foundry and leather), on the basis of having largest investments, highest numbers of employment and maximum no of units on purposive manner. From the clusters we selected a proportionate (50%) allocation of units will be done.

We would select the 30% SMEs having the largest number of units, highest investment, and the largest number of employment and the selection of industries are purposive. Therefore, the selection of respondents (employees) will be done randomly from the list of employees. And on the basis of the above parameters, we will be selecting auto-parts, foundry and leather industries comprising of 80, 70 and 90 number of units respectively.

Unit of observation

Primary data will be collected by using an interview from the owner/entrepreneurs, managers and engineer of each unit, therefore around 360 respondents will constitutes the sample size.

Stages of random sampling

- **I stage: -** Selection of 5% units from the total list of units.
- **II stage: -** Selection of 50% employees from the list of the total number of employees in each unit.

Statistical Tools for Analysis of Data

T-test, Structural Equation Modelling (PLS- SEM), ANOVA, regression, correlation, Etc., will be used to analyze the collected data.

References

1. Ademola Afolayan, Eoin Plant, Gareth R.T. White, Paul Jones, Paul Beynon-Davies, (2015), Information Technology Usage in SMEs in a Developing Economy
2. Alexandre Moeuf, Samir Lamouri, Robert Pellerin, Simon Tamayo Giraldo, (2017) , Industry 4.0 and the SME: a technology-focused review of the empirical literature
3. Amoako-Gyampah, K., & Salam, A. F. (2004). An extension of the technology acceptance model in an ERP implementation environment. Information & Management.

4. Bahjat Fakieh, (2018), SMEs Research: The Continuous Need to Explore the ICT Potential
5. Charles Davis, (2006), Enterprises Development Capabilities in Information Technology SMEs
6. Economics Times, (2021), https://economictimes.indiatimes.com/small-biz/sme-sector/why-technology-is-the-only-path-to-sustained-growth-for-msmes/articleshow/80281133.cms?from=mdr
7. Edmund Mallinguh, Christopher Wasike, and Zeman Zoltan, (2020), Technology Acquisition and SMEs Performance, the Role of Innovation, Export and the Perception of Owner-Managers
8. Elissaveta Gourova, (2012), Enhancing Knowledge Creation And Innovation In SME
9. Energy profile : Agra foundry clusters
10. Fauzan Ramadhan, (2020), Ahmad H. Sutawidjaya, Effect of operation management on firm performance of micro and small enterprises
11. Filippo Lanzini, Jolien Ubacht, Joachim de Greeff, (2021) , Blockchain adoption factors for SMEs in supply chain management
12. Francis Enu-Kwesi, Mustapha Osman Opoku, (2020), Relevance of the technology acceptance model (TAM) in information management research: a review of selected empirical evidence.
13. Government Of India, Ministry Of Micro, Small And Medium Enterprises (2020-21) Annul report.
14. Hart O. Awa, Ojiabo Ukoha, Bartholomew C. Emecheta (2015), Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs.
15. Industrial profile of Agra district, MSME- Development Institute of Agra.
16. Kristin Vogelsang, M. Steinhüser, Uwe Hoppe, (2013), A Qualitative Approach to Examine Technology Acceptance
17. Kwabena G. Boakye, Thomas McGinnis, Victor R. Prybutok, (2014) , TAM: A quality technology acceptance model for technology operations managers
18. Louis Raymond, (2005), Operations management and advanced manufacturing technologies in SMEs: A contingency approach

19. Ministry of Micro, Small, and Medium Enterprise. (2021). Retrieved from http://www.ppdcagra.dcmsme.gov.in/
20. Moh'd Anwer AL-Shboul, (2019) , Towards better understanding of determinants logistical factors in SMEs for cloud ERP adoption in developing economies
21. Monica Colin, Raquel Galindo, Octavio Hernández, (2015), Information and communication technology as a key strategy for efficient supply chain management in manufacturing SMEs.
22. Muhammad Ehsan Rana, Amir Saneifar, Ahmad Amini, (2013), SMEs on Cloud - Challenges and Opportunities
23. Mwamisha D. Mkala, Kenneth L. Wanjau, Teresia N. Kyalo, (2018), Operations Management and Performance of Manufacturing Small and Medium Enterprises in Kenya
24. Naief G Azyabi, (2017), The Role of Information Technology in Enhancing SMEs Capabilities through Knowledge Management
25. Nilubon Chonsawat, Apichat Sopadang, (2020) , Smart SMEs 4.0 Maturity Model to Evaluate the Readiness of SMEs Implementing Industry 4.0
26. Norm Archer, Shan Wang, Claire Kang, (2008) , Barriers to the adoption of online supply chain solutions in small and medium enterprises
27. Octavio Hernández Castorena, Luis Aguilera Enríquez, Martha González Adame, (2014), The influence of information technology and communication supply chain management performance for greater sme manufacturing in Aguascalientes
28. OECD SME and Entrepreneurship Outlook 2021
29. Peter Davis, Clay Dibrell, Justin Craig, (2008), Fueling Innovation through Information Technology in SMEs
30. Petra Schubert And Uwe Leimstoll, (2007), Importance and Use of Information Technology in Small and Medium-Sized Companies
31. Rani Maria Thomas, K. Narayanan, and A. Ramanathan, (2019) A comparative study of technology and industry clusters of SMEs in India.
32. RavinderKumar, Rajesh Kr.Singh, Yogesh Kr.Dwivedi, (2020) , Application of industry 4.0 technologies in SMEs for ethical and sustainable operations: Analysis of challenges

33. Rofikoh Rokhim, Permata Wulandari, Iin Mayasari, small medium enterprises technology acceptance model: a conceptual review
34. Sameer Mittal, Muztoba Ahmad Khan, Jayant K. Purohit, Karan Menon, (2019), A Smart Manufacturing Adoption Framework for SMEs
35. SME, camber of India
36. Sushanta Tripathy, Satyabrata Aich, Anurup Chakraborty, Gyu M. Lee, (2016) , Information technology is an enabling factor affecting supply chain performance in Indian SMEs: A structural equation modelling approach
37. Sushanta Tripathy, Satyabrata Aich, Anurup Chakraborty, Gyu M. Lee, (2016), Information technology is an enabling factor affecting supply chain performance in Indian SMEs: A structural equation modelling approach
38. Swetadri Srinivasan & Gurusiddayya, (2017), Operations Management in a Demanding World for SMEs